

ABSTRACT OF THE DISCLOSURE

Various laser shock processing methods are provided to establish selective compressive residual stress distribution profiles within a workpiece. An asymmetrical stress distribution profile may be formed through the thickness of a thin section of a gas turbine engine airfoil. One method involves simultaneously irradiating a workpiece with a set of laser beams to form a corresponding set of adjacent non-overlapping laser shock peened surfaces, enabling the shockwaves to encounter one another. Additionally, opposite sides of the workpiece may be irradiated at different times to form opposing laser shock peened surfaces, enabling the shockwaves to meet at a location apart from the mid-plane. Furthermore, opposite sides of the workpiece may be irradiated simultaneously using laser beams having different pulse lengths to form opposing laser shock peened surfaces. Moreover, opposite sides of the workpiece may be irradiated simultaneously to form a set of laterally offset laser shock peened surfaces.